

## 5 And We Claim:

1. An ultrasonic inspection system for inspecting walls of fluid reservoirs comprising a robotic vehicle,  
a transducer supported on the robotic vehicle and responsive to electrical energy for  
10 emitting corresponding sonic energy in a chosen direction,  
a support for the transducer on the robotic vehicle positioning the transducer so the chosen direction is broadside to a selected wall of the fluid reservoir,  
a drive circuit energizing the transducer with a broadband electrical pulse of duration in excess of that necessary for the sonic energy to transit the selected wall from one face to  
15 another, and  
an amplifier coupled to the transducer for receiving a signal from the transducer in response to sonic energy received from the selected wall.
2. The inspection system of claim 1 wherein the broadband electrical pulse includes  
20 energy up to about 3.5 MHz.
3. The inspection system of claim 1 wherein the broadband electrical pulse includes energy up to about 5 MHz.
- 25 4. The ultrasonic inspection system of claim 1 which includes an array of transducers, each transducer in the array supported to have chosen directions which are substantially parallel, wherein the drive circuit energizes each transducer with the broadband electrical pulse of substantially identical duration but offset in time from one another and wherein the amplifier has a separate channel for each transducer in the array.  
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5. The ultrasonic inspection system of claim 1 which further includes control means for de-energizing said drive circuit a predetermined time after initiation of the broadband electrical pulse.
- 35 6. The ultrasonic inspection system of claim 5 wherein the control means includes a gate array responsive to control data received just prior to a rise of said broadband electrical pulse.

- 5     7.     The ultrasonic inspection system of claim 1 wherein the broadband electrical pulse is swept in frequency.
8.     A drive circuit for an inspection instrument for ultrasonic inspection using a long broadband inspection pulse, comprising:
- 10         a receiver for receiving a long broadband inspection pulse,  
           a gated amplifier coupled to said receiver with an output connected to an ultrasonic transducer for driving said transducer with an amplified replica of said inspection pulse, and  
           control means responsive to control data for controlling deenergization of said gated amplifier in response to said control data,
- 15         whereby material under test adjacent to said transducer is subjected to ultrasonic energy produced by said transducer driven by said amplified inspection pulse.
9.     A drive circuit as recited in claim 8 wherein said gated amplifier includes:
- 20         an electronic amplifier coupled to an output of said receiver,  
           a controlled switch, and  
           a step up converter coupled between an output of said controlled switch and said transducer.
10.    A drive circuit as recited in claim 9 wherein said step up converter comprises a
- 25    transformer.
11.    A drive circuit as recited in claim 8 wherein said control means comprises a gate array, wherein said gated amplifier includes a controlled switch controlled by an output of said gate array.
- 30    12.    A drive circuit as recited in claim 8 wherein said transducer has a bandwidth in a range of about 3.5 MHz to 5 MHz
13.    An inspection vehicle obtaining power from an umbilical for operation in a liquid
- 35    environment in the vicinity of a combustion prone region, said vehicle comprising:

5 a junction box coupled via said umbilical to a source of electrical energy having at least one electrical energy parameter within an intrinsically safe limit,

a converter coupled to said junction box for increasing said at least one electrical energy parameter beyond said intrinsically safe limit, and

10 a sensor for detecting the environment immediately surrounding said vehicle to allow operation of said converter only if said sensor indicates that said vehicle is within said liquid environment.

15 14. The inspection vehicle of claim 13 wherein said umbilical provides electrical energy with voltage and current of levels which are intrinsically safe for the combustion prone region.

20 15. The inspection vehicle of claim 13 wherein said sensor responds to pressure surrounding said inspection vehicle to allow operation of said converter only if said sensor detects pressure surrounding said inspection vehicle indicating that said vehicle is submerged in said liquid environment and not in said combustion prone region.

25 16. An inspection system including the inspection vehicle of claim 15 and a power and signal source driving said umbilical, said inspection vehicle including:

a logic device for generating first and second control signals in response to a permissive signal from said power and signal source,

said power and signal source including:

30 a first switched power source responsive to signals from said sensor for allowing application of power to said vehicle via said umbilical, and

35 a signal source responsive to said sensor for generating said permissive signal in the event said sensor indicates that the vehicle is within said liquid environment.

5 17. The inspection system of claim 16 wherein the first and second control signals are coupled to said converter allowing, when received said increase in said electrical energy parameter.

18. The inspection system of claim 17 wherein said converter includes at least one transformer enabled by one of said control signals.

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19. The inspection vehicle of claim 13 wherein the converter is contained in an explosion proof container.

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20. . The inspection system of claim 15 wherein the converter is contained in an explosion proof container.

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